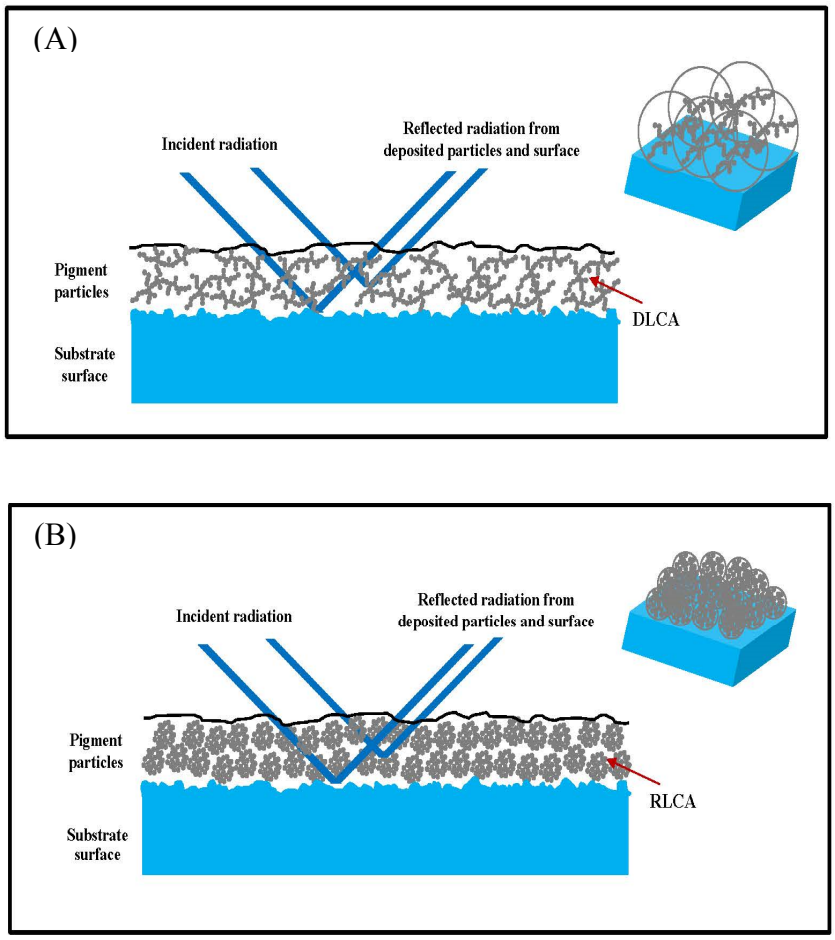
Effects of particle agglomerate deposits on the radiative response of heterogeneous coatings

Layth Al-Gabori[a,b] and M. Pinar Mengüç[a*]

[a]*Center for Energy, Environment and Economy (CEEE), Özyeğin University, 34794 Istanbul, Turkey*
[b]*Department of Materials Engineering, University of Technology, Baghdad, Iraq*

[*]*Presenting author (pinar.menguc@ozyegin.edu.tr)*

The optical and radiative properties of surfaces need to be designed for a variety engineering and industrial applications, such as electric power generation, solar energy harvesting systems, for innovative chemical processes, and building radiative cooling applications, among others. Many of these coatings are comprised of packed particles and their agglomerates, rather than homogeneous layers. The particulate deposits affect the radiative properties of surfaces not only because of their intrinsic optical properties, but also due to the structures of individual particles and their agglomerates [1]. Consequently, the reflection on the substrate and the upper interface of particulate deposits become more complicated, altering the radiative properties of surfaces as well [2].



Heterogeneous particulate deposits: (A) linear particle agglomerate shapes, and (B) compact particle agglomerate shapes.

The main objective of this study is to investigate the effects of the different characteristics of particle agglomerates and their optical properties on the radiative properties of heterogeneous particulate deposits on surfaces. The ultimate aim is to have optimized particle shapes and structures for specific applications. For this purpose, the radiative properties of different particle agglomerate structures are determined using the discrete dipole approximation (DDA and DDA-SI) techniques. The performances of different coatings to be evaluated in terms of their reflection and scattering behaviors. In addition, these radiative properties are to be used in the solution of the radiative transfer

equation (RTE), to determine the radiative behavior particulate deposits as a function a series of parameters, including optical depths of deposits and the substrate properties.

References

[1] Howell, J. R., Mengüç, M. P., and Siegel, R., 2016: *Thermal Radiation Heat Transfer*. CRC Press.
[2] Diebold, M. P., 2014: *Application of Light Scattering to Coatings*. Springer.

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